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Mark G. Lappin McDermott, Will & Emery 28 State Street Boston, MA 02109			EXAMINER BROWN, DREW J	
			ART UNIT 3616	PAPER NUMBER

DATE MAILED: 11/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/677,206	Applicant(s) KERREBROCK ET AL.	
	Examiner Drew J. Brown	Art Unit 3616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-60 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-60 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10/02/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>8/6/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: In lines 5 and 9 of page 5, line 12 of page 8, line 17 of page 10, line 22 of page 11, “preferable” should be --preferably--. In line 22 of page 12, “of the rubble” should be --into the rubble--, and in lines 20 and 21, “make” should be --makes--.

Appropriate correction is required.

Claim Objections

2. Claim 5 is objected to because of the following informalities: In line 2, “extending” should be --extends--, and in line 3, “device,” should be --device--.

Appropriate correction is required.

3. Claim 9 is objected to because of the following informalities: In line 3, “extend” should be --extends--. Appropriate correction is required.

4. Claim 33 is objected to because of the following informalities: In line 2, “side” should be --sides--. Appropriate correction is required.

5. Claim 49 is objected to because of the following informalities: In line 11, “includes” should be --include--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. Claims 1, 3-5, 7, 8, 10, 33-36, 45, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart (U.S. Pat. No. 6,107,795) in view of Pelrine et al. (U.S. Pat. No. 5,284,096).

With respect to claim 1, Smart discloses a distributed traction crawler device comprising an elongated flexible drive shaft (33) extending along a central axis, a motor (20) operatively connected to said drive shaft for rotating said drive shaft about said central axis (column 2, lines 25-27), and a plurality of segments disposed over said drive shaft between a proximal end and a distal end of the crawler device. A drive wheel (26) is rotatable about a wheel axis transverse to said central axis, wherein adjacent segments are joined to each other (Figure 2), and wherein at least two of the segments further include a drive coupling assembly (17) operatively connecting the wheel assembly to the drive shaft, so that rotating the drive shaft provides distributed traction force to the drive wheels of the at least two segments.

With respect to claim 39, the crawler device further comprises a drive unit (22), where the drive unit houses the motor (column 2, lines 16-19).

With respect to claim 45, the motor is an electric motor (column 2, lines 9-12).

With respect to claim 47, the drive coupling assembly is a gear assembly (column 2, lines 25-26).

With respect to claim 1, Smart does not disclose that each segment includes at least one drive wheel. However, Pelrine et al. does disclose that each segment (1A, 1B, and 1C) includes at least one drive wheel (column 3, lines 47-50). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was

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made to modify the invention of Smart in view of the teachings of Pelrine et al. to include at least one drive wheel with each segment in order to provide better traction.

With respect to claim 4, Pelrine et al. also discloses at least one steering wire (18) extending from a head segment which is located at the distal end of the crawler device, wherein the steering wire is substantially parallel with the drive shaft (Figure 12).

With respect to claim 5, at least one steering wire extends from the head segment to a steering end effector (12) at the proximal end of said crawler device.

With respect to claim 10, a tether (32) extends between a user control end (end of tether near control unit 31 in Figure 12) and a tether distal end (end of tether connected to segment 1C'), where the tether distal end is connected to the proximal end of said crawler device. At least one steering wire extends from the head segment along the crawler device and the tether to the user control end.

With respect to claim 7, Pelrine et al. does not disclose that at least one steering wire includes four steering wires for effecting two axes steering. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart to have four steering wires instead of the two that are shown in Figure 12, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

With respect to claim 8, Pelrine et al. does not disclose that the four steering wires are equally spaced about the drive shaft. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart to arrange the steering wires so they are equally spaced around the

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drive shaft, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

With respect to claim 3, Smart discloses that all the segments of said plurality of segments include the drive coupling assembly (17 in Figure 2), so that rotating said drive shaft provides distributed traction force to the drive wheels of all the segments.

With respect to claims 33 and 34, Smart does not disclose that the wheel assembly of each segment comprises two sets of wheels disposed on opposite sides of the segment, where each set included two drive wheels. Also, Smart does not disclose the wheel assembly of each segment comprises four sets of wheels disposed on four sides of the segment, where each set includes two drive wheels. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have two or four sets of wheels that include two drive wheels for each set, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

With respect to claim 35 and 36, Smart does not disclose that at least one drive wheel of the wheel assembly of each segment has a substantially conical shape. Smart also does not disclose that the at least one drive wheel of each segment includes circumferential tread patterns for traction. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the wheels in a conical shape to provide better traction and conform to the shape of the pipes. It would also have been obvious to provide tread patterns for traction because it is conventional in the art to provide treading on wheels to improve traction.

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8. Claims 1-9, 21, 33-36, 39, 40, 45, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart (U.S. Pat. No. 6,107,795) in view of Schempf et al. (U.S. Pat. No. 6,917,176 B2).

With respect to claim 1, Smart discloses a distributed traction crawler device comprising an elongated flexible drive shaft (33) extending along a central axis, a motor (20) operatively connected to said drive shaft for rotating said drive shaft about said central axis (column 2, lines 25-27), and a plurality of segments disposed over said drive shaft between a proximal end and a distal end of the crawler device. A drive wheel (26) is rotatable about a wheel axis transverse to said central axis, wherein adjacent segments are joined to each other (Figure 2), and wherein at least two of the segments further include a drive coupling assembly (17) operatively connecting the wheel assembly to the drive shaft, so that rotating the drive shaft provides distributed traction force to the drive wheels of the at least two segments.

With respect to claim 39, the crawler device further comprises a drive unit (22), where the drive unit houses the motor (column 2, lines 16-19).

With respect to claim 45, the motor is an electric motor (column 2, lines 9-12).

With respect to claim 47, the drive coupling assembly is a gear assembly (column 2, lines 25-26).

With respect to claim 1, Smart does not disclose that each segment includes at least one drive wheel. However, Schempf et al. does disclose that each segment (12) includes at least one drive wheel (28). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention

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of Smart in view of the teachings of Schempf et al. to include at least one drive wheel with each segment in order to provide better traction.

With respect to claim 2, Schempf et al. also discloses that the drive shaft includes successive sections joined by universal joints (claim 64).

With respect to claim 4, at least one steering wire extending from a head segment which is located at the distal end of the crawler device, wherein the steering wire is substantially parallel with the drive shaft (column 9, lines 43-54).

With respect to claim 5, at least one steering wire extends from the head segment to a steering end effector at the proximal end of said crawler device (column 9, lines 43-54).

With respect to claim 6, the steering end effector is a motor (column 9, lines 43-54).

With respect to claim 9, the motor is located at or near the proximal end of the crawler device (right end of device in Figure 1), and wherein the at least one steering wire extends to the motor (column 9, lines 43-54).

With respect to claim 21, the motor is adapted to selectively rotate the drive shaft in the clockwise and counterclockwise rotational motions (column 10, lines 13-18).

With respect to claim 40, the drive unit (12) is disposed at or near a proximal end of the drive shaft (drive unit on both sides of device in Figure 1).

With respect to claim 7, Schempf et al. does not disclose that at least one steering wire includes four steering wires for effecting two axes steering. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart to have four steering wires, since it has been held

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that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

With respect to claim 8, Schempf et al. does not disclose that the four steering wires are equally spaced about the drive shaft. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart to arrange the steering wires so they are equally spaced around the drive shaft, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

With respect to claim 3, Smart discloses that all the segments of said plurality of segments include the drive coupling assembly (17 in Figure 2), so that rotating said drive shaft provides distributed traction force to the drive wheels of all the segments.

With respect to claims 33 and 34, Smart does not disclose that the wheel assembly of each segment comprises two sets of wheels disposed on opposite sides of the segment, where each set included two drive wheels. Also, Smart does not disclose the wheel assembly of each segment comprises four sets of wheels disposed on four sides of the segment, where each set includes two drive wheels. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have two or four sets of wheels that include two drive wheels for each set, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

With respect to claim 35 and 36, Smart does not disclose that at least one drive wheel of the wheel assembly of each segment has a substantially conical shape. Smart also does not disclose that the at least one drive wheel of each segment includes

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circumferential tread patterns for traction. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the wheels in a conical shape to provide better traction and conform to the shape of the pipes. It would also have been obvious to provide tread patterns for traction because it is conventional in the art to provide treading on wheels to improve traction.

9. Claims 2, 6, 9, 21, and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Pelrine et al., and further in view of Schempf et al.

With respect to claim 2, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above, but does not disclose that the drive shaft includes successive sections joined by universal joints. However, Schempf et al. does disclose that the drive shaft includes successive sections joined by universal joints (claim 64). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Schempf to join successive sections with universal joints so as to allow the crawler device to bend to navigate around corners or rubble.

With respect to claim 6, Smart, as modified by Pelrine et al., also does not disclose that the steering end effector is a motor. However, Schempf does disclose that the steering end effector is a motor (column 9, lines 43-54). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Schempf to have the motor be the steering end effector to produce motion of the crawler device.

With respect to claim 9, Smart, as modified by Pelrine et al., does not disclose that the motor is located at or near the proximal end of the crawler device, and wherein

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the at least one steering wire extends to the motor. However, Schempf does disclose that the motor is located at or near the proximal end of the crawler device (right end of device in Figure 1), and wherein the at least one steering wire extends to the motor (column 9, lines 43-54). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Schempf to put the motor at the proximal end rather than near the head of the crawler device so, in case of frontal impact, the motor will not be damaged.

With respect to claim 21, Smart, as modified by Pelrine et al., does not disclose that the motor is adapted to selectively rotate the drive shaft in the clockwise and counterclockwise rotational motions. However, Schempf does disclose that the motor is adapted to selectively rotate the drive shaft in the clockwise and counterclockwise rotational motions (column 10, lines 13-18). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Schempf to allow the motor to rotate both ways so the crawler device can move forwards and backwards.

With respect to claim 40, Smart, as modified by Pelrine et al., does not disclose that the drive unit is disposed at or near a proximal end of the drive shaft. However, Schempf does disclose that the drive unit (12) is disposed at or near a proximal end of the drive shaft (drive unit on both sides of device in Figure 1). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Schempf to dispose the drive unit at or near a proximal end of the drive shaft so, in case of frontal impact, the motor will not be damaged.

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Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Schempf et al., and further in view of Pelrine et al.

Smart, as modified by Schempf et al., does not disclose that a tether extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of said crawler device, and wherein at least one steering wire extends from the head segment along the crawler device and the tether to the user control end.

However, Pelrine does disclose that a tether (32) extends between a user control end (end of tether near control unit 31 in Figure 12) and a tether distal end (end of tether connected to segment 1C'), where the tether distal end is connected to the proximal end of said crawler device. Also, at least one steering wire extends from the head segment along the crawler device and the tether to the user control end. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Pelrine et al. to have a tether extend between a user control end and a proximal end of the crawler device so a user can control the motion of the crawler device without being near the device.

10. Claims 11-20, 22-32, 42-44, 46, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Pelrine et al., and further in view of Grant et al. (U.S. Pat. No. 6,450,104 B1).

With respect to claim 11, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above but does not disclose a tether that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device. However, Grant et al. does disclose a tether (220)

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that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device (Figure 13). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have a tether that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device so a user can control the motion of the crawler device without being near the device.

With respect to claim 18, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above but does not disclose a control system that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor. However, Grant et al. does disclose a control system (235) that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor (Figure 13 and column 14, lines 33-51). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have a control system that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor so a user can control the motion of the crawler device without being near the device.

With respect to claims 22, 29, and 30, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above but does not disclose a video camera, light, microphone, or infrared sensor that are disposed on or near a head segment located at the distal end of the crawler device. However, Grant et al. does disclose a video

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camera (188), a light (195), a microphone (column 1, lines 47-50), and an infrared sensor (column 1, line 56) that are disposed on or near a head segment located at the distal end of the crawler device (Figure 1 and Figure 10A). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have a video camera that is disposed on or near a head segment located at the distal end of the crawler device so the user can view the path of the crawler to search for defects in pipes, victims in rubble, etc. It would also have been obvious to have a light when traveling in dark areas, a microphone to hear victims needing help, and an infrared sensor to detect the heat of victims.

With respect to claim 43, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above but does not disclose that adjacent segments of the plurality of segments are joined by articulated joints. However, Grant et al. does disclose that adjacent segments are joined by articulated joints (column 7, lines 18-20). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the adjacent segments be joined by articulated joints so the crawler device can maneuver around corners and through rubble.

With respect to claims 44 and 46, Smart, as modified by Pelrine et al., discloses the claimed invention as discussed above but does not disclose that the motor is a hydraulic motor or a pneumatic motor. However, Grant et al. does disclose that a hydraulic (column 9, lines 9-12) or a pneumatic (column 9, lines 1-3) motor is used. Therefore, it would have been obvious to one having ordinary skill in the art at the time

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the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the motor be hydraulic or pneumatic because they are well-known in the art to provide similar functions.

With respect to claim 13, Grant et al. also discloses a tube (47 or 97) that extends from the distal end of the crawler device along the crawler device and the tether to a user control end (Figure 11A and 11B).

With respect to claim 14, the tube is adapted for transmitting air (column 14, lines 41-43).

With respect to claim 15, the tube is adapted for transmitting fluid (column 9, lines 9-15).

With respect to claim 17, a cable (216A or 216B) supplies power from an external source to the motor, where the cable extends along the tether (column 14, lines 44-46).

With respect to claim 19, the control system includes a joystick (310, Figure 13).

With respect to claim 20, the crawler device further includes a tether (220) connected to the proximal end of the crawler device, wherein the communication link means includes a cable for transmitting control signals from the control system to the motor, and wherein the cable extends along the tether (column 14, lines 33-51).

With respect to claim 23, the camera is remotely steerable (column 17, lines 45-48).

With respect to claim 24, a communication system (225) transmits signals from the video camera to an external video display system (column 15, lines 5-7).

With respect to claim 25, the crawler device further includes a tether that extends from the proximal end of the crawler device to the display system, and wherein the

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communication system includes a cable that extends along the crawler device and the tether for transmitting signals received by the video camera to the external video display system (column 14, lines 41-48 and column 15, lines 5-7).

With respect to claim 42, the drive unit (70) is disposed between and joined to two segments (20 and 120) of the plurality of segments.

With respect to claim 26, Smart also discloses that the device further comprises an orientation sensor (claim 11).

With respect to claim 12, Smart does not disclose that the motor is positioned remote from the crawler device and is operatively coupled to the drive shaft by way of a drive cable extending along the tether. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to rearrange the location of the motor to have to remote from the crawler device, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

With respect to claim 27, Smart does not disclose that the orientation sensor is a gravity sensor. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the orientation sensor be a gravity sensor in order to balance the crawler device while in motion and to react to its orientation.

With respect to claim 28, Smart does not disclose a processing system that is connected to the orientation sensor and is programmed to orientate images received from the video camera and displayed on a display system to an upright view based on signals received from the orientation sensor. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a processing

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system orientate the images received from the video camera so the user can easily interpret what is being viewed.

With respect to claim 16, Grant does not disclose that the tether is semi-rigid. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the tether semi-rigid in order to protect the cables within while also allowing the tether to bend to travel around corners and rubble.

With respect to claim 32, Grant does not disclose that a cable extends from the head segment to a user control end for transmitting signals bi-directionally between he microphone, the speaker, and the operator. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a cable extend from the head segment to a user control end for transmitting signals bi-directionally between he microphone, the speaker, and the operator so the operator will be able to hear a victim needing help.

11. Claims 11-20, 22-32, 41-44, 46, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Schempf et al., and further in view of Grant et al. (U.S. Pat. No. 6,450,104 B1).

With respect to claim 11, Smart, as modified by Schempf et al., discloses the claimed invention as discussed above but does not disclose a tether that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device. However, Grant et al. does disclose a tether (220) that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device (Figure 13). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was

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made to further modify the invention of Smart in view of the teachings of Grant et al. to have a tether that extends between a user control end and a tether distal end, where the tether distal end is connected to the proximal end of the crawler device so a user can control the motion of the crawler device without being near the device.

With respect to claim 18, Smart, as modified by Schempf et al., discloses the claimed invention as discussed above but does not disclose a control system that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor. However, Grant et al. does disclose a control system (235) that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor (Figure 13 and column 14, lines 33-51). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have a control system that is located at a remote position from the crawler device, where the communication link transmits control signals from the control system to the motor so a user can control the motion of the crawler device without being near the device.

With respect to claims 22, 29, and 30, Smart, as modified by Schempf et al., discloses the claimed invention as discussed above but does not disclose a video camera, light, microphone, or infrared sensor that are disposed on or near a head segment located at the distal end of the crawler device. However, Grant et al. does disclose a video camera (188), a light (195), a microphone (column 1, lines 47-50), and an infrared sensor (column 1; line 56) that are disposed on or near a head segment located at the distal end of the crawler device (Figure 1 and Figure 10A). Therefore, it would have been obvious

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to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have a video camera that is disposed on or near a head segment located at the distal end of the crawler device so the user can view the path of the crawler to search for defects in pipes, victims in rubble, etc. It would also have been obvious to have a light when traveling in dark areas, a microphone to hear victims needing help, and an infrared sensor to detect the heat of victims.

With respect to claim 43, Smart, as modified by Schempf et al., discloses the claimed invention as discussed above but does not disclose that adjacent segments of the plurality of segments are joined by articulated joints. However, Grant et al. does disclose that adjacent segments are joined by articulated joints (column 7, lines 18-20).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the adjacent segments be joined by articulated joints so the crawler device can maneuver around corners and through rubble.

With respect to claims 44 and 46, Smart, as modified by Schempf et al., discloses the claimed invention as discussed above but does not disclose that the motor is a hydraulic motor or a pneumatic motor. However, Grant et al. does disclose that a hydraulic (column 9, lines 9-12) or a pneumatic (column 9, lines 1-3) motor is used.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the motor be hydraulic or pneumatic because they are well-known in the art to provide similar functions.

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With respect to claim 13, Grant et al. also discloses a tube (47 or 97) that extends from the distal end of the crawler device along the crawler device and the tether to a user control end (Figure 11A and 11B).

With respect to claim 14, the tube is adapted for transmitting air (column 14, lines 41-43).

With respect to claim 15, the tube is adapted for transmitting fluid (column 9, lines 9-15).

With respect to claim 17, a cable (216A or 216B) supplies power from an external source to the motor, where the cable extends along the tether (column 14, lines 44-46).

With respect to claim 19, the control system includes a joystick (310, Figure 13).

With respect to claim 20, the crawler device further includes a tether (220) connected to the proximal end of the crawler device, wherein the communication link means includes a cable for transmitting control signals from the control system to the motor, and wherein the cable extends along the tether (column 14, lines 33-51).

With respect to claim 23, the camera is remotely steerable (column 17, lines 45-48).

With respect to claim 24, a communication system (225) transmits signals from the video camera to an external video display system (column 15, lines 5-7).

With respect to claim 25, the crawler device further includes a tether that extends from the proximal end of the crawler device to the display system, and wherein the communication system includes a cable that extends along the crawler device and the tether for transmitting signals received by the video camera to the external video display system (column 14, lines 41-48 and column 15, lines 5-7).

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With respect to claim 41, any two adjacent segments of the plurality of segments are joined by an articulated joint (column 7, lines 18-20).

With respect to claim 42, the drive unit (70) is disposed between and joined to two segments (20 and 120) of the plurality of segments.

With respect to claim 26, Smart also discloses that the device further comprises an orientation sensor (claim 11).

With respect to claim 12, Smart does not disclose that the motor is positioned remote from the crawler device and is operatively coupled to the drive shaft by way of a drive cable extending along the tether. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to rearrange the location of the motor to have to remote from the crawler device, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

With respect to claim 27, Smart does not disclose that the orientation sensor is a gravity sensor. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the orientation sensor be a gravity sensor in order to balance the crawler device while in motion and to react to its orientation.

With respect to claim 28, Smart does not disclose a processing system that is connected to the orientation sensor and is programmed to orientate images received from the video camera and displayed on a display system to an upright view based on signals received from the orientation sensor. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a processing

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system orientate the images received from the video camera so the user can easily interpret what is being viewed.

With respect to claim 16, Grant does not disclose that the tether is semi-rigid. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the tether semi-rigid in order to protect the cables within while also allowing the tether to bend to travel around corners and rubble.

With respect to claim 32, Grant does not disclose that a cable extends from the head segment to a user control end for transmitting signals bi-directionally between the microphone, the speaker, and the operator. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have a cable extend from the head segment to a user control end for transmitting signals bi-directionally between the microphone, the speaker, and the operator so the operator will be able to hear a victim needing help.

12. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Pelrine, and further in view of Schempf et al. and Grant et al.

Smart, as modified by Pelrine and Schempf, discloses the claimed invention as discussed above but does not disclose that any two adjacent segments of the plurality of segments are joined by an articulated joint.

However, Grant et al. does disclose that two segments are joined by an articulated joint (column 7, lines 18-20). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to join two segments with an articulated joint so the crawler device can maneuver around corners and through rubble.

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13. Claims 49-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Schempf et al., Pelrine et al. and Grant et al.

Smart discloses a distributed traction crawler device that has an elongated flexible drive shaft that extends along a central axle between a proximal end and a distal end. A plurality of segments are exposed over the drive shaft, and the drive unit houses a motor that is operatively connected to the drive shaft for rotating the drive shaft about the central axis. The drive wheel also rotates about a wheel axis transverse to the central axis, and at least two segments further include a drive coupling assembly that operatively connects the wheel assembly to the flexible drive shaft, so that rotating the drive shaft provides distributed traction to the drive wheels of the at least two segments. Finally, Smart discloses at least one detecting means.

Smart does not disclose a drive unit disposed at the proximal end of said drive shaft. Smart also does not disclose that each segment has a wheel assembly including at least one drive wheel, wherein an articulated joint joins adjacent segments of the plurality of segments.

However, Schempf et al. does disclose that a drive unit is disposed at the proximal end of said drive shaft. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Smart in view of the teachings of Schempf to dispose the drive unit at or near a proximal end of the drive shaft so, in case of frontal impact, the motor will not be damaged.

Pelrine et al. does disclose that each segment has a wheel assembly including at least one drive wheel. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Smart in view of

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the teachings of Pelrine et al. to include at least one drive wheel with each segment in order to provide better traction.

Grant et al. does disclose that adjacent segments are joined by articulated joints. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the adjacent segments be joined by articulated joints so the crawler device can maneuver around corners and through rubble. Grant et al. also discloses that a detecting means is disposed on a head segment that is located at the distal end of the drive shaft. Therefore, it would have also been obvious to have the detector means be located on the head segment so the crawler device can look forward in the direction of travel to spot a victim or problem while still having the compact design to fit in confined areas.

With respect to claim 50, Grant et al. discloses a communication system, where the communication system provides a communication link between the at least one detecting means and an operator.

With respect to claim 51, the communication system is adapted for providing two way communications.

With respect to claim 52, a tether is connected to the drive unit.

With respect to claim 53, a cable transmits information between the at least one detecting means and a control system, where the cable extends from the at least one detecting means to the control system.

With respect to claim 54, the at least one detecting means includes a video camera.

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With respect to claim 55, the at least one detecting means includes a microphone.

With respect to claim 56, a speaker is mounted on the head segment.

14. Claims 57-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smart in view of Pelrine et al. and Grant et al.

Smart discloses a distributed traction crawler device that has an elongated flexible drive shaft that extends along a central axle between a proximal end, through a drive unit, and a distal end. A plurality of segments are exposed over the drive shaft, and the drive unit houses a motor that is operatively connected to the drive shaft for rotating the drive shaft about the central axis. The drive wheel also rotates about a wheel axis transverse to the central axis, and at least two segments further include a drive coupling assembly that operatively connects the wheel assembly to the flexible drive shaft, so that rotating the drive shaft provides distributed traction to the drive wheels of the at least two segments.

Smart does not disclose that each segment has a wheel assembly including at least one drive wheel, wherein an articulated joint joins adjacent segments of the plurality of segments. Smart also does not disclose that two segments are disposed at two opposite ends of the drive unit. Finally, Smart does not disclose that at least two crawler units are connected by an elongated tether.

However, Pelrine et al. does disclose that each segment has a wheel assembly including at least one drive wheel. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Smart in view of the teachings of Pelrine et al. to include at least one drive wheel with each segment in order to provide better traction.

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Grant et al. does disclose that adjacent segments are joined by articulated joints. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify the invention of Smart in view of the teachings of Grant et al. to have the adjacent segments be joined by articulated joints so the crawler device can maneuver around corners and through rubble. Grant also discloses that two segments (120 and 20) are disposed at two opposite ends of the drive unit (70). It would have also been obvious to have two segments surround the drive unit so that the drive unit is protected in case of a frontal collision.

With respect to claim 59, although Smart does not disclose that at least two crawler units are connected by a tether, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have at least two crawler units be connected by a tether, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

With respect to claim 58 and 60, Smart discloses that all the segments of the plurality of segments include the drive coupling assembly, so that rotating the drive shaft provides distributed traction force to the drive wheels of all the segments.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Smart, Himmler, Ruch et al., and Yagi et al. all disclose similar crawler devices.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Drew J. Brown whose telephone number is 571-272-1362.

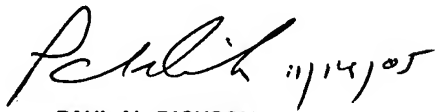
The examiner can normally be reached on Monday-Thursday from 7 a.m. to 4 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul N. Dickson can be reached on 571-272-6669. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Drew J Brown
Examiner
Art Unit 3616

DJB


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